Package 'ResIN'

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Type Package

Title Response Item Networks ('ResIN')

Version 1.1.0

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Description
Contains various tools to perform and visualize Response Item Networks ('ResIN's'). 'ResIN' binarizes ordered-categorical and qualitative response choices from (survey) data, calculates pairwise associations and maps the location of each item response as a node in a force-directed network. Please refer to <https://www.resinmethod.net/> for more details.

License GPL-3

URL https://github.com/pwarncke77/ResIN

BugReports https://github.com/pwarncke77/ResIN/issues

Depends R (>= 4.1.0)

Imports ggplot2 (>= 3.4.2), dplyr (>= 1.0.0), fastDummies (>= 1.6.3), qgraph (>= 1.9.4), igraph (>= 1.4.2), wCorr (>= 1.9.6), Matrix, DirectedClustering (>= 0.1.1)

Encoding UTF-8

LazyData true

RoxygenNote 7.2.3

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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R topics documented:

`lik_data` *Likert-type simulated data for "ResIN" package examples*

Description

An artificially created data-set (n=1000) of 12, 5-point Likert data. Modeled on the basis of a standard normal data-generating process. Likert scales contain 20 percent uncorrelated, homoscedastic measurement error. This data-set is used for the examples in the "ResIN" package vignette.

Usage

```
data(lik_data)
```

Format

An object of class `"data.frame"`

References

This data set was artificially created for the ResIN package.

Examples

```
data(lik_data)
head(lik_data)
```

ResIN *ResIN*

Description

Performs Response Item-Network (ResIN) analysis

Usage

```
ResIN(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  poly_ncor = 2,
  remove_negative = TRUE,
  EBICglasso = FALSE,
  EBICglasso_arglist = NULL,
  node_covars = NULL,
  node_costats = NULL,
  network_stats = FALSE,
  cluster = FALSE,
  seed = 42
)
```

Arguments

df	A data-frame object containing the raw data.
node_vars	An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e. the subset of attitude variables in df).
cor_method	Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".
weights	An optional continuous vector of survey weights. Should have the same length as number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the weightedCorr function from the wCorr package.
method_wCorr	If weights are supplied, which method for weighted correlations should be used? Defaults to "Polychoric". See wCorr::weightedCorr for all correlation options.
poly_ncor	How many CPU cores should be used to estimate polychoric correlation matrix? Only used if cor_method = "polychoric".

remove_negative
: Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.

EBICglasso
: Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, `EBICglasso` function from the `qgraph` packages performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.

EBICglasso_arglist
: An argument list feeding additional instructions to the `EBICglasso` function if `EBICglasso` is set to TRUE.

node_covars
: An optional character string selecting quantitative covariates that can be used to enhance ResIN analysis. Typically, these covariates provide grouped summary statistics for item response nodes. (E.g.: What is the average age or income level of respondents who selected a particular item response?) Variable names specified here should match existing columns in `df`.

node_costats
: If any `node_covars` are selected, what summary statistics should be estimated from them? Argument should be a character vector of the same length of `node_covars`and call a base-R function. (E.g. `"mean"`, `"median"`, `"sd"`). The first element in `node_costats` specifies the summary statistic extracted from the first element in `node_covars`, and so on.

network_stats
: Should common network structuration and centralization metrics be extracted? Calls `qgraph::centrality_auto` and `DirectedClustering::ClustF` to the ResIN graph object to extract network average betweenness, closeness, strength centrality (mean) and centralization scores (sd). Also estimates network expected influence, average path length, and global clustering coefficients.

cluster
: Optional, should community detection be performed on item response network? Defaults to FALSE. If set to TRUE, performs "cluster_leading_eigen" function from the igraph package and stores results in node_frame.

seed
: Random seed for force-directed algorithm.

Value

A list object containing the ResIN adjacency matrix (`adj_matrix`), a numeric vector detailing which item responses belong to which item (`same_items`), a ggplot-ready edge-list type dataframe (`edgelist_frame`), a node-level dataframe (`node_frame`), a vector with the optional graph structuration (`graph_structuration`) and centralization (`graph_centralization`) statistics, as well as the dummy-coded item-response dataframe (`df_dummies`).

Examples

```
## Load the 12-item simulated Likert-type ResIN toy dataset
data(lik_data)
library(ggplot2)

# Apply the ResIN function to toy Likert data:
output <- ResIN(lik_data, cor_method = "spearman", network_stats = TRUE, cluster = TRUE)
```

```
# Create a basic outcome plot with ggplot
output$edgelist_frame <- output$edgelist_frame[order(output$edgelist_frame$Strength,
                                                     decreasing = FALSE), ]
ResIN_plot <- ggplot2::ggplot(output$edgelist_frame)+
  geom_curve(data = output$edgelist_frame, aes(x = from.x, xend = to.x, y = from.y,
                                               yend = to.y, linewidth = weight,
                                               color = Strength), curvature = 0.2)+
  geom_point(aes(x = from.x, y = from.y, shape = as.factor(cluster)), size = 8)+
  geom_point(aes(x = to.x, y = to.y), size = 8)+
  geom_text(data = output$edgelist_frame, aes(x = from.x, y = from.y, label = from),
            size = 3, color = "white")+
  geom_text(data = output$edgelist_frame, aes(x = to.x, y = to.y, label = to),
            size = 3, color = "white")+
  ggtitle("ResIN example  plot")+
  theme_dark()+
  theme(axis.text.x = element_blank(), axis.title.x = element_blank(),
        axis.text.y = element_blank(), axis.title.y = element_blank(),
        axis.ticks = element_blank(), panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(), legend.position = "none",
        legend.text = element_blank(), plot.title = element_text(hjust = 0.5))

ResIN_plot
```

ResIN_igraph *ResIN_igraph*

Description

Performs Response Item-Network analysis (ResIN) and exports the results as an igraph object.

Usage

```
ResIN_igraph(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  remove_negative = TRUE,
  igraph_arglist = NULL,
  EBICglasso = FALSE,
  EBICglasso_arglist = NULL,
  cluster = TRUE,
  seed = 42
)
```

Arguments

df	A data-frame object containing the raw data.
node_vars	An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e. the subset of attitude variables in df).
cor_method	Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".
weights	An optional continuous vector of survey weights. Should have the same length as number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the weightedCorr function from the wCorr package.
method_wCorr	If weights are supplied, which method for weighted correlations should be used? Defaults to "Polychoric". See wCorr::weightedCorr for all correlation options.
remove_negative	Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.
igraph_arglist	An optional argument list feeding additional instructions to igraph. Needs to be specified as an object list containing the arguments to be passed down.
EBICglasso	Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, EBICglasso function from the qgraph packages performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.
EBICglasso_arglist	An argument list feeding additional instructions to the EBICglasso function if EBICglasso is set to TRUE.
cluster	Optional, should community detection be performed on item response network? Defaults to FALSE. If set to TRUE, performs "cluster_leading_eigen" function from the igraph package and stores results in plotting_frame.
seed	Random seed for force-directed algorithm.

Value

A list object containing the igraph output object, a numeric vector detailing which item responses belong to which item (same_items), and optionally a matrix detailing community membership of different item nodes (clustering).

References

Csardi G, Nepusz T (2006). "The igraph software package for complex network research." InterJournal, Complex Systems, 1695. https://igraph.org.

Examples

```
## Load the 12-item simulated Likert-type ResIN toy dataset
data(lik_data)

## Run the function:

ResIN_igraph <-  ResIN_igraph(lik_data)


## Plot and/or investigate as you wish:
igraph::plot.igraph(ResIN_igraph$igraph_obj)
```

ResIN_qgraph *ResIN_qgraph*

Description

Performs Response Item-Network analysis (ResIN) and exports the results as an qgraph object.

Usage

```
ResIN_qgraph(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  remove_negative = TRUE,
  plot_graph = TRUE,
  plot_title = "ResIN qgraph",
  qgraph_arglist = NULL,
  EBICglasso = FALSE,
  EBICglasso_arglist = NULL,
  same_item_groups = FALSE,
  cluster = FALSE
)
```

Arguments

df	A data-frame object containing the raw data.
node_vars	An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e. the subset of attitude variables in df).
cor_method	Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".

`weights` An optional continuous vector of survey weights. Should have the same length as number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the `weightedCorr` function from the `wCorr` package.

`method_wCorr` If weights are supplied, which method for weighted correlations should be used? Defaults to `"Polychoric"`. See `wCorr::weightedCorr` for all correlation options.

`remove_negative` Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.

`plot_graph` Optionally, should `qgraph` generate print the network upon generation? Defaults to TRUE.

`plot_title` Optionally, assign a title to the `qgraph` plot.

`qgraph_arglist` An optional argument list feeding additional instructions to `qgraph`. Needs to be specified as an object list containing the arguments to be passed down.

`EBICglasso` Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, `EBICglasso` function from the `qgraph` packages performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.

`EBICglasso_arglist` An argument list feeding additional instructions to the `EBICglasso` function if `EBICglasso` is set to TRUE. Needs to be specified as an object list containing the arguments to be passed down.

`same_item_groups` Optionally, should the qgraph object automatically incorporate a "group" attribute that groups item response nodes by the items that repose nodes stem from?

`cluster` Optional, should community detection be performed on item response network? Defaults to FALSE. If set to TRUE, performs "cluster_leading_eigen" function from the igraph package and stores results in plotting_frame.

Value

A list object containing the `qgraph` output object, a numeric vector detailing which item responses belong to which item (`same_items`), and optionally a matrix detailing community membership of different item nodes (`clustering`).

References

Epskamp S, Cramer AOJ, Waldorp LJ, Schmittmann VD, Borsboom D (2012). "qgraph: Network Visualizations of Relationships in Psychometric Data." Journal of Statistical Software, 48(4), 1–18.

Examples

```
## Load the 12-item simulated Likert-type ResIN toy dataset
data(lik_data)

## Run the function:
ResIN_qgraph <-  ResIN_qgraph(lik_data, same_item_groups = TRUE)
```

ResIN_utils *ResIN_utils*

Description

Generates auxiliary utensils useful for Response-Item Networks analysis.

Usage

```
ResIN_utils(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  remove_negative = TRUE,
  EBICglasso = FALSE,
  EBICglasso_arglist = NULL
)
```

Arguments

df	A data-frame object containing the raw data.
node_vars	An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e. the subset of attitude variables in df).
cor_method	Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".
weights	An optional continuous vector of survey weights. Should have the same length as number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the weightedCorr function from the wCorr package.
method_wCorr	If weights are supplied, which method for weighted correlations should be used? Defaults to "Polychoric". See wCorr::weightedCorr for all correlation options.
remove_negative	Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.

EBICglasso Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, EBICglasso function from the qgraph packages performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.

EBICglasso_arglist
An argument list feeding additional instructions to the EBICglasso function if EBICglasso is set to TRUE.

Value

A list object containing the original dataframe, (resin_df), the dummy-coded dataframe (resin_dummies), the ResIN correlation and covariance matrices (resin_cor & resin_vcov), and a numeric vector detailing which item responses belong to which item (same_items).

References

Epskamp S, Cramer AOJ, Waldorp LJ, Schmittmann VD, Borsboom D (2012). "qgraph: Network Visualizations of Relationships in Psychometric Data." Journal of Statistical Software, 48(4), 1–18.

Examples

```
## Load the 12-item simulated Likert-type ResIN toy dataset
data(lik_data)

## Extract the utilities
output <- ResIN_utils(lik_data)
```

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